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TITLE: Some properties of thin layers of the systems Cu-Se and Cu-Te

SOURCE: Kishinev. Universitet. Uchenyye zapiski. v. 49, 1961, 123-128

TEXT: Hitherto only little attention has been paid to the compounds of the systems Cu-Se and Cu-Te, and little is known on their properties. Here the physical properties of films having various compositions were investigated. The dependence of monochromatic light transmission and resistivity on composition was determined in films prepared according to Vekshinskiy's method: electrolytic Cu, and spectroscopically pure Se or Te, were evaporated in vacuo from point evaporators and were condensed onto glass bases at 20-350°C. Gold or aquadag electrodes were used for measuring σ. Since the properties of such films depend on their thickness only within the range d < 2000-2500Å, the layers investigated were 6000-9000Å thick. The resistivity in vacuo was found to have a maximum at 38-39 wt% Se,

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but this maximum was observed also when the preparation was held in air for 48 hrs; it was only somewhat lower. The thermo-emf α had a peak corresponding to the same composition which was identified as p-type Cu_2Se. Transmission and reflection of 0.9μ light had a maximum (minimum) also at this composition. Measurements of σ(T) showed that σ decreased with increasing T from 20 to 250°C when the copper content exceeded the stoichiometric by more than 1%. The temperature coefficient of resistivity was $4 \cdot 10^{-4} deg^{-1}$ when the copper excess reached 3%, and $8 \cdot 10^{-4} deg^{-1}$ when it was 5%. The course of σ(T) was indicative of Cu_2Se being an impurity semiconductor with an activation energy of 0.5 ev. The Cu_2Se resistivity was independent of the backing temperature and also of successive heat treatment. The properties of Cu_2Se did not change irreversibly until it was heated above 200°C. If, however, the temperature of the backing onto which the layer had been deposited, was higher than 200°C, the layer could be heated up to the base temperature without

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irreversible changes in the properties. Similar results were obtained for the Cu-Te system. The maxima arise at 50wt% Te, i. e. the film consists of Cu_2Te only. It is also a p-type semiconductor with an activation energy of 0.15-0.18 ev. Intrinsic conductivity arises on heating above 200°C. Both Cu_2Te and Cu_2Se would be suitable materials for thermoelements. There are 4 figures.